FINAL

TOTAL MAXIMUM DAILY LOAD (TMDL)

In

Fenholloway River

Bevins (Boggy) Creek

Econfina River Basin

(Includes TMDLs for Dissolved Oxygen, Biochemical Oxygen Demand, Unionized Ammonia, Fecal Coliform, and Dioxin)

Taylor and LaFayette Counties, Florida

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April 2007

Under the authority of Section 303(d) of the Clean Water Act, 33 U.S. Code §1251 et.seq., as amended by the Water Quality Act of 1987 (PL 100-4), the U.S Environmental Protection Agency is hereby establishing Total Maximum Daily Loads (TMDLs) for dissolved oxygen, biochemical oxygen demand, unionized ammonia, and dioxin in the Fenholloway River, and fecal coliform in Bevins (Boggy) Creek, Econfina River Basin. Subsequent actions must be consistent with these TMDLs.

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James D. Giattina, Director
Water Management Division

Date

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LIST OF ABBREVIATIONS

ADOC	Alternative Dissolved Oxygen Criteria
BOD	Biochemical Oxygen Demand (5-day test)
CBOD	Chemical Biochemical Oxygen Demand (5-day test)
CFS	Cubic Feet per Second
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
EPA	Environmental Protection Agency
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
HUC	Hydrologic Unit Code
LA	Load Allocation
MGD	Million Gallons per Day
MOS	Margin of Safety
MPN	Most Probable Number or counts
MS4	Municipal Separate Storm Sewer Systems
NLCD	National Land Cover Data
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OSTD	Onsite Sewer Treatment and Disposal Systems
PPQ	Parts per quadrillion
PPT	Parts per Trillion
RM	River Mile
SRWMD	Suwannee River Water Management District
TMDL	Total Maximum Daily Load
UAA	Use Attainability Analysis
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WASP	Water Quality Assessment Simulation Program
WBID	Water Body Identification
WLA	Waste Load Allocation
WQS	Water Quality Standard
WWTF	Wastewater Treatment Facility

SUMMARY SHEET
Total Maximum Daily Load (TMDL)

1. 303(d) Listed Waterbody Information

State: Florida
County: Taylor and Lafayette Counties
Major River Basin: Econfina River Basin (HUC 03110102)
Listed Waterbodies (1998 303(d) List):

WBID	Segment Name	Constituent(s)
3473A	Fenholloway River at Mouth	Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Dioxin
3473B	Fenholloway River below Pulp Mill	DO, BOD, Unionized Ammonia
3603	Bevins / Boggy Creek	Fecal Coliform

2. TMDL Endpoints (i.e., Targets)

DO: The State of Florida water quality criterion for freshwater segments requires that in no case shall the concentration be less than 5.0 mg/l. The water quality criterion for marine segments requires in no cases shall the concentration be less than 5.0 mg/l in a 24-hour period and shall never be less than 4 mg/l.

BOD: The State of Florida water quality criterion requires that the concentration shall not be increased to exceed values that would cause the dissolved oxygen to be depressed below its water quality criterion and, in no case shall it be great enough to produce nuisance conditions. Therefore, the dissolved oxygen water quality criterion applies to biochemical oxygen demand.

Dioxin (2,3,7,8-TCDD): The EPA-promulgated water quality criterion in the State of Florida for marine segments requires that in no case shall dioxin concentrations be greater than 0.014 parts per quadrillion (ppq).

Unionized Ammonia: The State of Florida water quality criterion for fresh water segments requires ammonia concentrations less than or equal to 0.02 mg/l.

Fecal Coliform: The State of Florida water quality criterion requires no more than 400 counts per 100mL in 10% of the samples.

3. TMDL Components to Achieve DO Criteria in Fenholloway River:

Stream Name	Parameter	WLA	LA	TMDL
Fenholloway River	DO	4110 lb/day	Natural background levels	4110 lb/day
Fenholloway River	BOD	2 mg/l or 717 lb/day	2 mg/l or 333 lb/day	1050 lb/day
Fenholloway River	Ammonia	0.07mg/l or 25 lb/day	0.07 mg/l or 12 lb/day	37 lb/day

Notes: 1) BOD represents 5-day BOD or BOD_5; 2) BOD and ammonia concentration and loading values are expressed as maximum monthly averages; 3) DO allocation is expressed as a minimum average daily load based on adding 1.5 million lbs of oxygen per year; and 4) ammonia WLA achieves the applicable DO and unionized ammonia criteria at end-of-pipe.

If FDEP adopts and EPA approves the Establishment of an Alternative Dissolved Oxygen Criteria for the Fenholloway River, the TMDL for DO is as follows:

Stream Name	Parameter	WLA	LA	TMDL
Fenholloway River	DO	5 mg/l	Natural background levels	5 mg/l
Fenholloway River	BOD	3.5 mg/l or 1278 lb/day	2 mg/l or 333 lb/day	1611 lb/day
Fenholloway River	Ammonia	1.0 mg/l or 365 lb/day	0.07 mg/l or 12 lb/day	377 lb/day

Notes: 1) BOD represents 5-day BOD or BOD_5; 2) BOD concentration and loading values are expressed as maximum monthly averages; and 3) DO allocation is expressed as a minimum discharge concentration.

4. Dioxin (2,3,7,8-TCDD) Allocation:

WBID	WLA	LA	TMDL
Fenholloway River 3473A	0.014 ppq	0	0.014 ppq

Note: WLA expressed as a maximum average daily concentration in parts per quadrillion (ppq)

5. Fecal Coliform Allocation for Bevins (Boggy) Creeks (WBID 3603)

Parameter	WLA	LA	TMDL	MOS
Fecal Coliform	0	78 % reduction	78 % reduction	Implicit

Note: The TMDL expressed as a daily load is equivalent to 4.74×10^{10} MPN/day.

6. Public Notice Date: September 30, 2003

7. TMDL Considers Point Source, Nonpoint Source, or both: Both

8. Major NPDES Discharges to surface waters

Facility Name	NPDES No.	Facility Type	Receiving Stream
Buckeye Florida Pulp Mill	FL0000876	Industrial Wastewater	Fenholloway River
City of Perry (no discharge – land application)	FL0026387	Domestic WWTP	Spring Branch

TOTAL MAXIMUM DAILY LOAD (TMDL)
ECONFINA RIVER BASIN (HUC 03010102)

1 INTRODUCTION

Section 303(d) of the Clean Water Act requires each state to list those waters within its boundaries for which technology based effluent limitations are not stringent enough to attain water quality standards applicable to the water's designated use(s). Listed waters are prioritized with respect to designated use classifications and the severity of pollution. In accordance with this prioritization, states are required to develop Total Maximum Daily Loads (TMDLs) for those water bodies that are not meeting water quality standards. The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a waterbody based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water quality based controls to reduce pollution from both point and non-point sources and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Florida Department of Environmental Protection (FDEP) developed a statewide, watershed-based approach to water resource management. Under the watershed management approach, water resources are managed on the basis of natural boundaries, such as river basins, rather than political boundaries. FDEP uses the watershed management approach for implementing TMDLs. The State's 52 basins are divided into 5 groups. Water quality is assessed in each group on a rotating five-year cycle. The impaired waterbodies addressed in this TMDL are in the Econfina Basin. The Econfina Basin is part of the Group 1 basin, which was first assessed in 2000 with plans to revisit water management issues in 2005. The Florida Legislature established five water management districts (WMD) that are responsible for managing ground and surface water supplies in the counties encompassing the districts. The Ecofina Basin is in the Suwannee River Water Management District (SRWMD).

For the purpose of planning and management, the Econfina Basin is divided into three planning units: Econfina River, Fenholloway River and Steinhatchee River basins. A planning unit is either an individual primary tributary basin or a group of adjacent primary tributary basins with similar characteristics. These planning units contain smaller, hydrological-based units called drainage basins, which are further divided into "water segments". A water segment usually contains only one unique waterbody type (stream, lake, cannel, etc.) and is about five square miles. Unique numbers or waterbody identification (WBIDs) numbers are assigned to each water segment.

2 Problem Definition

Florida's Section 303(d) list identified several WBIDs in the Econfina River Basin as not supporting water quality standards (WQS). The U.S. Environmental Protection Agency (EPA) assessed all available water quality information and determined the Fenholloway River impaired for dissolved oxygen (DO), biochemical oxygen demand (BOD), dioxin, nutrients, and unionized ammonia; and Bevins (Boggy) Creek impaired for fecal coliform. This TMDL report addresses the DO, BOD, unionized ammonia, fecal coliform, and dioxin impairments for the WBIDs listed in Table 1. Throughout this report BOD refers to the concentration obtained from the 5-day BOD test, and not the ultimate BOD concentration resulting from a longer testing period. The TMDLs that EPA is establishing in this report are pursuant to the 1998 Consent Decree in the Florida TMDL lawsuit (Florida Wildlife Federation, et al. v. Carol Browner, et al., Civil Action No. 4: 98CV356-WS, 1998).

EPA proposed nutrients (total nitrogen and total phosphorus) TMDLs in the Fenholloway River (WBIDs 3473A and 3473B) in September, 2003. Nutrient TMDLs are not being finalized in this report, as Buckeye Florida pulp mill, the major point source discharge to the river, is conducting further study on the impact its effluent has on algae blooms in the river and estuary. In addition, allocations for total coliform were proposed for Bevins (Boggy) Creek (WBID 3603); however, FDEP no longer has a water quality standard for total coliform, thus a TMDL is no longer necessary.

Table 1. TMDLs Developed By EPA in Econfina River Basin

WBID	Segment Name	Constituent(s)
3473A	Fenholloway at Mouth	DO, BOD, Dioxin (2,3,7,8-TCDD)
3473B	Fenholloway below Pulp Mill	DO, BOD, Unionized Ammonia
3603	Bevins / Boggy Creek	Fecal Coliform

The format of the remainder of this report is as follows: Chapter 3 is a general description of the watersheds of the Econfina River Basin, Fenholloway River, and Bevins (Boggy) Creek; Chapter 4 describes the water quality standard and target criteria for the TMDLs; Chapter 5 describes the development of the DO, BOD, and unionized ammonia TMDLs for Fenholloway River; Chapter 6 describes the development of the dioxin TMDL; and Chapter 7 describes the development of a fecal coliform TMDL for Bevins (Boggy) Creek. Chapters 3 and 4 are general and apply to all the TMDL parameters. Within each chapter is a section describing the data assessment, source assessments, and TMDL development.

3 WATERSHED DESCRIPTION

The Fenholloway River is located in northern Florida in the Econfina River Basin as shown in Figure 1 . The river is a blackwater stream with similar physical characteristics to the Econfina River. The Fenholloway River is 36 miles long and its watershed drains approximately 392 square miles. The upper areas of the watershed are underlain by the

Floridan Aquifer system. The aquifer system is confined in the upper headwaters and becomes semi-confined and unconfined as it moves southwest across San Pedro Bay. As the Fenholloway River continues toward the Gulf of Mexico, the watershed is underlain by a shallow surficial aquifer that is approximately 5 to 20 feet below ground surface. Sandy soils dominate the watershed area, though karst features are also present. Exposed limestone can be seen in the reaches on the Fenholloway River upstream of the Buckeye Florida pulp mill, which is the major point source discharge to the Fenholloway River. The pulp mill has impacted the hydrology and water quality of the Fenholloway River since 1954.

The land cover for the WBIDs identified in this TMDL report are based on the National Land Cover Dataset (NLCD) of 1995, and tabulated in Table 2. As Table 2 indicates, wetlands and forests (planted pine plantations) account for the majority of the land use in the WBIDs addressed in this TMDL report.

The Econfina River spans the length of Taylor County, which drains ultimately into the Gulf of Mexico. The Econfina River lies within the Gulf Coast Flatwoods subecoregion (75a). Within the Econfina River basin, the land distribution is a combination of pine flatwoods and swamp forests, and the land use consists of cropland, pastures, and mixed forest. Since 1992, minimally disturbed reference streams have been sampled throughout Florida for the purpose of establishing biological community expectations, and identifying specific thresholds for assessing stream health. The Stream Condition Index (SCI) has been the primary assessment method, which consists of collecting 20 D-frame dipnet sweeps (0.5 meter in length) of the most productive habitats in a 100 meter (m) reach of stream. The organisms are sub-sampled, sorted, and identified to the lowest practical taxonomic level. Seven measurements of invertebrate health are calculated and compared with the expectations established by the reference site sampling. These reference streams are sampled periodically to maintain accurate expectations to which other streams in the same region are compared. SCI scores for the Econfina River were in the “excellent” range for three of the four sampling trips conducted between 1995 and 2001. The lowest of the four SCI scores was in the “good” range in February, 1995. Overall, results indicate the Econfina River is a healthy system.

Physical/chemical parameters and nutrients were sampled at three sites along the Econfina River (at Highway 14, Highway 27, and Highway 98) in April, 1999 (FDEP, 1999). Nutrient concentrations were not problematic in the Ecofina River, tending to be lower than average for Florida streams on most sampling dates. All measured physical/chemical parameters and water quality variables at the three stations met acceptable criteria for Class III waterbodies. Dissolved oxygen concentration exceeded the Class III water quality standard of 5.0 mg/l at all stations sampled. The healthy habitat and water quality observed in the Econfina River as well as similar landuse make the Ecofina River an ideal reference stream for developing the DO and BOD TMDLs in the Fenholloway River.

Figure 1. Location of Fenholloway Watershed

Table 2. 1995 Land Cover Distribution (acres)

Category	Ecofina Watershed		Fenholloway Watershed		Steinhatchee Watershed	
	Area	%	Area	%	Area	%
Residential	160	0%	5220	3%	45	0%
Commercial, industry, & public	95	0%	902	1%	258	0%
Agriculture	4004	2%	5675	3%	501	0%
Rangeland	3585	2%	10036	6%	799	0%
Forest	57782	35%	65847	39%	67714	32%
Water	680	0%	351	0%	94	0%
Wetlands	81277	49%	64158	38%	104186	50%
Barren and extractive	16919	10%	17498	10%	35482	17%
Transportation and Utilities	0	0%	632	0%	0	0%
Total Area	164503	100%	170320	100%	209078	100%

Bevins (Boggy) Creek is located in Taylor County in the Steinhatchee Planning Unit of the Suwannee River Basin. Bevins Creek is a tributary to the Steinhatchee River, which discharges into the Gulf of Mexico (see Figure 2). Land cover in the watershed is shown in Table 3 and is based on the National Land Cover Dataset (NLCD) obtained from 1990 Lands at Thematic Mapper Data (Vogelmann, 2001). In this table, urban area includes land cover classified as commercial, industrial, and transportation, and agriculture area includes land cover classified as rangeland. The dominant land features of the Bevins Creek watershed are wetlands and forest. Although the NLCD data is from 1990 images, the land cover in the Taylor County area has not changed significantly. According to Suwannee Basin Status Report, the Steinhatchee River watershed is 98 percent pine flatwoods and wetlands, most of which is used for commercial timber production (FDEP, 2001).

Table 3. Land Use in the Bevins (Boggy) Creek Watershed (acres)

Urban		Agriculture		Forest		Wetlands		Water		Barren, transitional		Total
Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area
45	0.28	218	.96	5954	26	11,862	52	14.7	0.06	4575	20	22,668

Note: the total watershed area is equivalent to 35 square miles

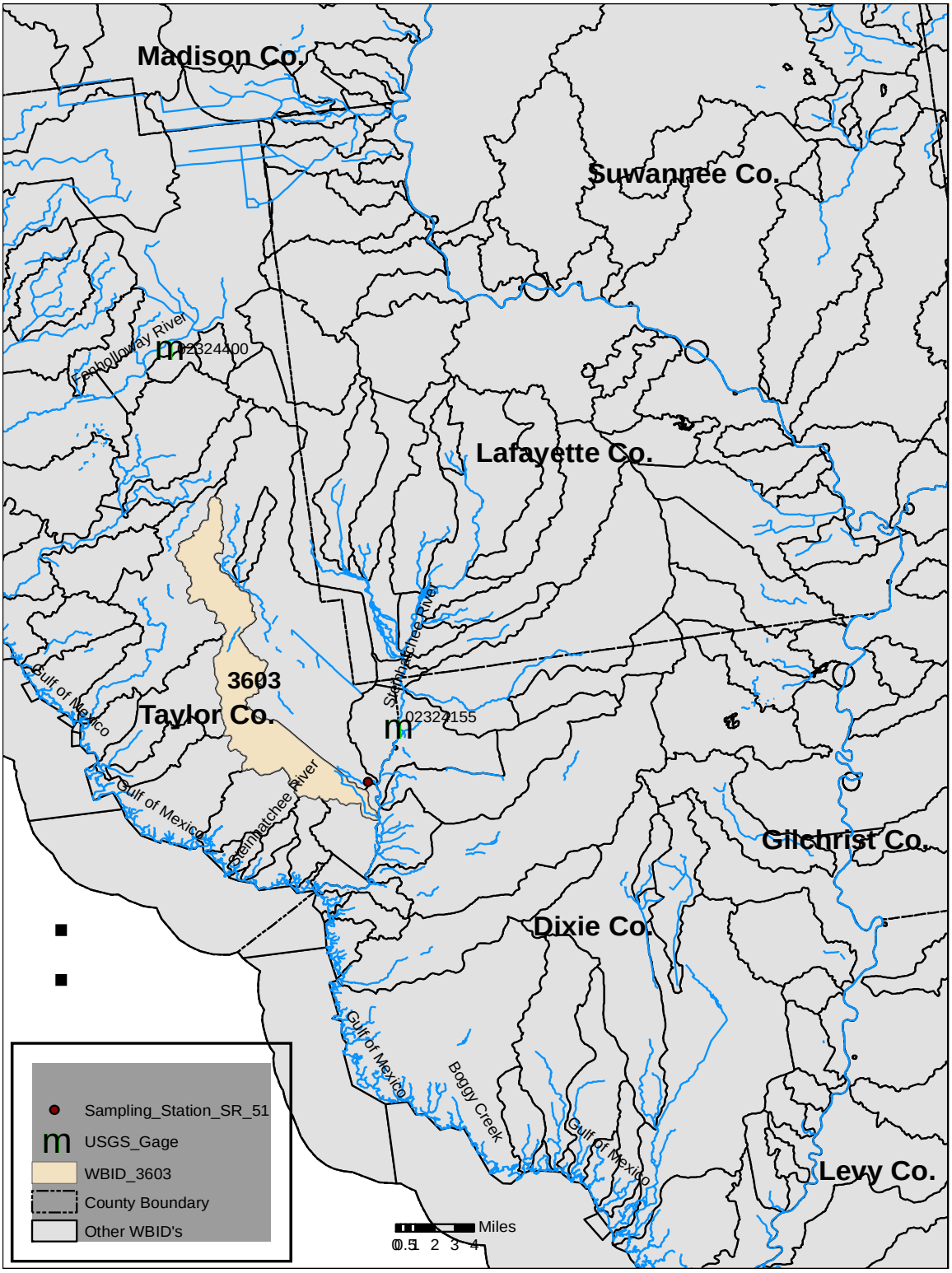

Figure 2. Location of the Bevins Creek Watershed

4 WATER QUALITY STANDARD AND TARGET IDENTIFICATION

In 1947, the Florida state legislature designated the Fenholloway River as Class V for navigation, utility, and industrial use. In 1997, the designated use of the Fenholloway River was changed to Class III based on the findings of a Use Attainability Analysis (UAA) completed by FDEP in December, 1994. Class III waters have a designated use of recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife. The numeric water quality criteria for protection of Class III waters are established by the State of Florida in the Florida Administrative Code (FAC), Section 62-302.530. The individual criteria should be considered in conjunction with other provisions in water quality standards, including Section 62-302.500 FAC [Surface Waters: Minimum Criteria, General Criteria] that apply to all waters unless alternative or more stringent criteria are specified in FAC Section 62-302.530. In addition, unless otherwise stated, all criteria express the maximum not to be exceeded at any time. The specific criteria for the constituents addressed in this TMDL report are discussed below.

4.1 Dissolved Oxygen

The Class III water quality criterion for DO in freshwater segments (WBID 3473B), as established by Rule 62-302.530(31) FAC, states that DO shall not be less than 5 mg/l and normal daily and seasonal fluctuations above these levels shall be maintained. The water quality criterion for marine segments (WBID 3473A) requires in no cases shall the concentration be less than 5.0 mg/l in a 24-hour period and shall never be less than 4 mg/l. The TMDL for the Fenholloway River is written such that the wasteload allocations provided at the current discharge location attain this standard, by setting BOD and ammonia effluent values at background levels and the addition of oxygen.

While the Fenholloway River was verified as not supporting the Class III DO criterion, there is evidence indicating DO levels for other rivers in the Econfina River basin are less than the freshwater criterion due to natural conditions. The low DO levels in the Econfina River basin can be partly attributed to the wetland areas that border the river channel and naturally drain into the river. The freshwater portion of the Econfina River has measured minimum, average, and maximum DO values of 0.9 mg/l, 5.4 mg/l and 8.7 mg/l, respectively. These data have been collected from 1992 to 2002 at stations in the fresh water portion of the river by various parties and agencies, including the SRWMD and Buckeye Florida. The complete data set is presented in the FDEP spreadsheet for determining site-specific criteria for DO in the Econfina River, which is included in the administrative record of this TMDL. These ranges of DO values are representative of normal healthy blackwater systems. Based on this information, the development of an alternative DO criterion appears to be warranted for streams in the Econfina River Basin, including the Fenholloway River. However, until FDEP establishes an alternative DO criterion for the river, and EPA approves the alternative criterion, the applicable DO water quality criterion used in this TMDL is the statewide value of 5 mg/l.

4.2 Unionized Ammonia

The unionized ammonia criterion states that in no case shall concentrations exceed 0.02 mg/l. The unionized ammonia criterion is based on ammonia, temperature, and pH. The concentration of unionized ammonia increases with increasing temperature and pH. The ammonia levels required to meet the DO criteria will assure that the unionized ammonia criteria is attained with an instream pH less than or equal to 7.5 and a stream temperature less than or equal to 30 degrees Celsius.

4.3 Dioxin (2,3,7,8-TCDD)

The dioxin criterion is applied at a level less than or equal to 0.014 ppq. EPA promulgated this criterion in 1992 for the State of Florida under the 1992 National Toxics Rule.

4.4 Fecal Coliform Bacteria

The fecal coliform bacteria criteria states that the most probable number (MPN) or membrane filter (MF) counts per 100 ml of fecal coliform bacteria shall not exceed a monthly average of 200 MPN, nor exceed 400 MPN in 10 percent of the samples, nor exceed 800 MPN on any one day. The monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. The geometric mean criteria reflect chronic or long-term water quality conditions, whereas the 400 and 800 values reflect acute or short-term conditions. The target for the TMDL is the not to exceed 10 percent criterion, as this is the more stringent of the acute criteria.

When flow data are available in the WBID, the fecal coliform TMDLs are expressed as daily loads in units of counts per day. When flow data are not available in the WBID, or hydrologic and/or geologic conditions make it is difficult to estimate flow (i.e., tidal influence or karst geologic formation), the TMDLs are expressed only as percent reductions. The percent reduction is calculated based on the maximum concentration exceeding the 400 MPN criteria.

5 DO, BOD, and Unionized Ammonia TMDLS

This section of the report describes the development of the DO, BOD, and unionized ammonia TMDLs for the Fenholloway River. The TMDLs are based on a reference condition approach using the Ecofina River as an unimpacted reference site. A reference condition approach is consistent with EPA's peer-reviewed nutrient criteria guidance and was used to develop a local (i.e., WBID) target (USEPA, 2000). Depending on the type and extent of available data, EPA suggests three methods for determining targets: 1) directly determined from an unimpacted reference site; 2) empirically determined from a dataset from unimpacted reference sites; or 3) empirically determined from an all stream dataset. EPA chose approach number one for the reasons discussed in Section 3.

5.1 Water Quality Assessment

FDEP maintains ambient monitoring stations throughout the basin for the purposes of 303(d) listing and TMDL development. The Buckeye Florida Pulp Mill collects DO and other chemical data on a daily basis in the Fenholloway River at SR-356, as well as contracts special studies in the Econfina River basin. From 1998 to 2001, DO data were collected approximately monthly to quarterly at SR-356, Cooey Bridge, and Fish Camp by Environmental Planning & Analysis, Inc., a contractor for Buckeye (see Figure 1). In addition, EPA conducted special studies in both the river and estuary areas of the Econfina and Fenholloway Rivers from 1989 to 1999. A statistical summary of available DO data used in the TMDL analysis is shown in Table 4. All water quality data collected in the Fenholloway and Ecofina Rivers are provided in the Fenholloway modeling report (USEPA, 2003). In general, DO and unionized ammonia water quality standard excursions occur within the riverine portion of the Fenholloway River.

Table 4. DO Statistics (USEPA, 2003)

Location	No. of Samples	Mean (mg/l)	Standard Deviation (mg/l)
SR-356	848	0.918	0.5462
Cooey Bridge	37	2.132	1.4064
Fish Camp	141	3.473	2.0076

5.2 Source Assessment

An important part of the TMDL analysis is the identification of source categories, source subcategories, or individual sources of pollutants in the watershed and the amount of loading contributed by each of these sources. Sources are broadly classified as either point or nonpoint sources.

5.2.1 Point Sources

A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source discharges of industrial wastewater and treated sanitary wastewater must be authorized by National Pollutant Discharge Elimination System (NPDES) permits. NPDES permitted facilities, including certain urban stormwater discharges such as municipal separate stormwater systems (MS4 areas), certain industrial facilities, and construction sites over one acre, are storm-water driven sources considered “point sources” in this report. There are no MS4 jurisdictions impacting the impaired WBIDs.

There are two major NPDES point sources discharging to the Fenholloway River. Facilities discharging the pollutants of concern to surface waters are assigned a waste load allocation (WLA) in the TMDL analysis. These facilities are the City of Perry Wastewater Treatment Facility (WWTF) (FL0026387) and Buckeye Florida Pulp Mill (FL0000876). The City of Perry WWTF ceased discharging to surface waters in 2004, and is now using a land treatment system with no river discharge; therefore, this facility is not included in the WLA portion of the TMDL. Buckeye discharges into the Fenholloway River upstream of Hwy 98, about 20 miles from the mouth of the river (see Figure 1). Buckeye has a design flow of 43.8 million gallons per day (MGD) and is permitted to discharge BOD and ammonia at average concentrations of 22 mg/l and 3.3 mg/l, respectively.

5.2.2 Nonpoint Sources

Nonpoint sources of pollution are diffuse sources that cannot be identified as entering a waterbody through a discrete conveyance at a single location. These sources generally, but not always, involve accumulation of pollutants on the land surface that wash off as a result of storm events. The vast majority of the nonpoint source runoff in the Econfina River Basin and Fenholloway River watershed are natural background levels of pollutants running off wetlands, forest and other non anthropogenic areas. The nonpoint source runoff in the basin does not adversely impact natural water quality conditions.

5.3 Analytical Approach

EPA applied comprehensive hydrodynamic and water quality models to address the complex nature of the Fenholloway River-Estuary system. The purpose of the modeling exercise was to investigate what reductions in BOD and other pollutant loads were required to protect the designated uses of the Fenholloway River and offshore waters. The modeling framework consists of a three-dimensional model of the lower portions of the river and the near shore waters of the Gulf of Mexico, as well as a one-dimensional model of the upper segments of the river above the point of salt water intrusion. Details of these models are included in the Fenholloway River and Estuary: Hydrodynamic and Water Quality Modeling Report (USEPA, 2003).

5.3.1 Model Development and Calibration

Two models were used to simulate flow and water quality in the Fenholloway River, estuary, and offshore areas. A one-dimensional, hydrodynamic and water quality model was developed and calibrated for the upper portions of the river. This model extended from downstream of the riverine location of the Fish Camp station (RM 2.6) and extended upstream to CR-356C (RM 26.5), which is upstream of Buckeye's discharge location. The second model was a three-dimensional (3-D) hydrodynamic and water quality model, and includes the riverine portion described above, as well as the near shore area with coverage 2 miles offshore, 4.5 miles north and 4.5 miles south of the mouth.

Both the one-dimensional and three-dimensional hydrodynamics of the Fenholloway River and estuary were modeled using the Environmental Fluid Dynamics Code (EFDC). EFDC was applied with water surface elevation forcing at the downstream boundary and freshwater inflows at the upstream boundaries. Water surface elevation, flows, currents, salinity, temperature, and color were simulated using EFDC. Color was simulated within the EFDC model application as a conservative substance.

The U.S. EPA Water Quality Analysis Simulation Program (WASP), version 6.1 was applied as the water quality model (Ambrose et al., 1993; Wool et. al., 2001). The eutrophication component of WASP was used to simulate the dissolved oxygen sag within the riverine portion. The purpose of the modeling exercise was to determine what reductions in BOD and ammonia loadings were required to meet the DO water quality standards within the riverine portions and estuary. The WASP model is driven by the hydrodynamics simulated in the EFDC model. The flows and circulation projected by EFDC are used to drive the transport of material within the WASP model.

The simulation period of the models was 1998 to 2001. Data utilized in the development of hydrodynamic boundary conditions and for the purpose of model calibration consisted of the following types:

- Measured freshwater flows within the Fenholloway River and Spring Creek,
- Measured flows from point source discharges,
- Measured and projected tides within the Gulf of Mexico,
- Measured meteorological data, and
- Measured salinity, temperature and color at various stations throughout the system.

The calibration of DO in the riverine model was undertaken at three locations: SR-356 (RM 13.9), Cooey Bridge (RM 7.3), and Fish Camp (RM 2.6) as shown in Figure 4. At all three locations, the comparisons of modeled and measured data appear to be capturing the seasonal trends and the magnitude of the DO concentrations. Examination of the results shows a recovery of DO levels moving downstream from SR-356, which corresponds with the data.

As stated previously, EPA would expect that the Fenholloway River without the NPDES discharge would be a naturally low DO wetlands-dominated system with characteristics similar to those observed in the Econfina River. To replicate the DO ranges observed in the Ecofina River, model results indicate that monthly average BOD and ammonia concentrations are required to be less than or equal to 3.5 and 1 mg/l, respectively. This ammonia level meets the unionized ammonia criteria of 0.02 mg/l.

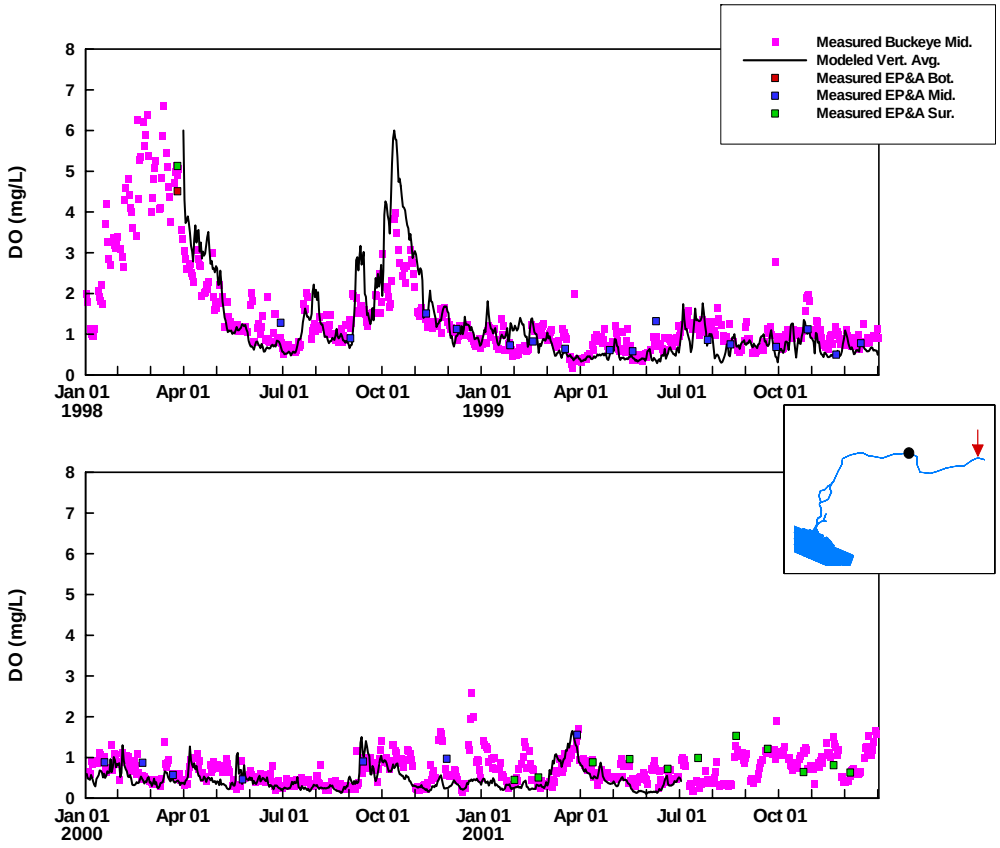

Figure 3. DO Calibration for Fenholloway River

5.3.2 Model Scenario Development

To meet the Class III DO standard of 5 mg/l, further treatment alternatives would need to be considered including adding 1.5 million pounds of oxygen per year of to the Fenholloway River at every one-mile increments whenever the segments of the river have a DO concentration below 5 mg/l. This alternative was evaluated in the mid 1990s and determined to be physically unfeasible, in that it would require extensive modification to the Fenholloway River channel. Another alternative considered is a no discharge option. The Fenholloway River without a point source discharge would mimic the natural DO range of the Econfina River.

EPA believes an ADOC may be appropriate for the Fenholloway River in order to reflect the naturally low DO characteristics of the river. To avoid the need to modify this TMDL, EPA is establishing an alternative TMDL for DO that is applicable should FDEP adopt an ADOC based upon the DO profile observed in the Econfina River. It will be necessary to revise the TMDL should FDEP establish, and EPA approve, an ADOC different from the one discussed in this report.

In order to allow consistent comparisons between the alternatives, the model was run for a single year period under each scenario. The critical period for scenario evaluations was chosen as year 2000, as this was a below average precipitation year and represents worst case low flow conditions. It was expected during periods of drought, Buckeye discharge is a larger portion of the river flow, resulting in less dilution to color and pollutant loadings.

5.4 Development of Total Maximum Daily Loads

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-stream water quality conditions. A TMDL can be expressed as the sum of all point source loads (Waste Load Allocations, WLA), non-point source loads (Load Allocations, LA), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$TMDL = \Sigma WLAs + \Sigma LAs + MOS$$

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR §130.2 (i) states that TMDLs can be expressed in terms of mass per time (e.g. pounds per day), toxicity, or other appropriate measure.

5.4.1 Determination of TMDL Components

The TMDL represent the maximum daily load the stream can assimilate and maintain water quality standards. The Fenholloway River is an effluent dominated system, and loadings from nonpoint sources are from natural background. To achieve a minimum DO concentration of 4 mg/l and a daily average of 5 mg/l, the TMDL allocates to BOD and ammonia, as shown in Table 5. The TMDL also calls for the addition of dissolved oxygen through permit covered by the wasteload allocation. While the ammonia and BOD allocations are expressed as a maximum, the DO allocation is expressed as a minimum necessary to achieve the water quality criterion. If the discharge location of Buckeye Florida is moved to the estuary, the TMDL allocates to BOD, as shown in Table 6. Allocations provided in Table 6 are for informational purposes only and do not reflect the TMDL being established at this time.

Table 5. TMDL Components to Achieve DO Criteria in Fenholloway River:

Stream Name	Parameter	WLA	LA	TMDL
Fenholloway River	DO	4110 lb/day	Natural background levels	4110 lb/day
Fenholloway River	BOD	2 mg/l or 717 lb/day	2 mg/l or 333 lb/day	1050 lb/day
Fenholloway River	Ammonia	0.07mg/l or 25 lb/day	0.07 mg/l or 12 lb/day	37 lb/day

Notes: 1) BOD represents 5-day BOD or BOD_5; 2) BOD and ammonia concentration and loading values are expressed as maximum monthly averages; 3) DO allocation is expressed as a minimum average daily load based on adding 1.5 million lbs of oxygen per year; and 4) ammonia WLA achieves the applicable DO and unionized ammonia criteria at end-of-pipe.

Table 6. Potential TMDL values with ADOC

Stream Name	Parameter	WLA	LA	TMDL
Fenholloway River	DO	5 mg/l	Natural background levels	5 mg/l
Fenholloway River	BOD	3.5 mg/l or 1278 lb/day	2 mg/l or 333 lb/day	1611 lb/day
Fenholloway River	Ammonia	2.0 mg/l or 365 lb/day	0.07 mg/l or 12 lb/day	377 lb/day

Notes: 1) BOD represents 5-day BOD or BOD_5; 2) BOD concentration and loading values are expressed as maximum monthly averages; and 3) DO allocation is expressed as a minimum discharge concentration.

5.4.2 Waste Load Allocations

The specific WLA are dependent on the applicable DO criteria for the Fenholloway River as outlined in Table 5 and Table 6. A WLA is not provided for the City of Perry because they do not discharge to surface waters.

5.4.3 Load Allocations

The vast majority of the nonpoint source runoff discharging into the Fenholloway River is natural background levels of pollutants originating from wetlands, forests, and other non-anthropogenic areas. The nonpoint source runoff in the watershed does not adversely impact natural water quality conditions.

5.5 Margin of Safety

There are two methods for incorporating a MOS in the analysis: a) implicitly incorporate the MOS using conservative model assumptions to develop allocations; or b) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. An implicit MOS was used in the TMDL analysis through conservative modeling assumptions. Three years were simulated in the water quality model, including two critical low flow years. The critical low flow year of 2000 was used to evaluate the pollutant impacts for developing the TMDLs. In addition, the BOD and ammonia instream decay rates were maintained at levels measured during the mid 1990s. With higher levels of treatment these decay rates may be lower, which would provide additional assimilative capacity.

5.6 Seasonal Variation

Seasonal variation was incorporated in the models by using the 1998 to 2000 critical period of record of flow recorded at the gages. Seasonality was also addressed by using all water quality data associated with the impaired streams, which was collected during multiple seasons.

5.7 Alternative Wastewater Discharge Location

Ongoing work is being done to evaluate an alternative estuary wastewater discharge location, with the discharge point located 1.7 miles upstream from the mouth of the Fenholloway River. The hydrodynamic and water quality model extends into the Gulf of Mexico, and the grid includes the proposed estuary discharge location. These models were calibrated for the alternative discharge location area and were used to determine new effluent limitations for Buckeye Florida (see Table 7). These limits were calculated to protect the alternative DO criterion under low flow and high summer temperature conditions.

Table 7. Proposed Effluent Permit Limits for Buckeye

Parameter	Value
Flow	43.8 MGD
CBOD	11 mg/l
Ammonia	1.0 mg/l
DO	5 mg/l

FDEP may revise this TMDL during the life of the permit containing these or other appropriate limits that is protective of the DO regime of the Fenholloway River and estuary. Once a TMDL has been established and adopted by rule, FDEP shall revise the Buckeye Florida permit to be consistent with the WLA provided in the TMDL.

There are concerns that nutrients from the discharge may increase chlorophyll concentrations to levels in the estuary that would cause a water quality standard impairment. To address these issues Buckeye has undertaken additional monitoring and modeling activities. Recent nutrient and chlorophyll data are reported by Barry Vittor and Associates, Inc. in their April 2006 report entitled “Ecological Monitoring of the Fenholloway and Econfina Rivers, 2005” (Barry Vittor and Associates, Inc, 2006). Buckeye’s consultants will also conduct additional nutrient modeling analysis to assess the possible effluent nutrient reductions that might be required to prevent harmful chlorophyll concentrations.

EPA proposed a nutrient TMDL for the Fenholloway River in September 2003. EPA is not establishing a nutrient TMDL at this time. The ongoing monitoring and modeling activities undertaken by Buckeye will be considered by EPA in evaluating further action on the proposed nutrient TMDL.

6 Dioxin TMDL

This section of the TMDL report details the development of a TMDL for dioxin in lower Fenholloway River (WBID 3477A). The dioxin addressed in this report is 2,3,6,8-TCDD.

6.1 Water Quality Assessment and Deviation from Target

The Fenholloway River (WBID 3473A) was included on the 1998 303(d) list for dioxin based on a fish tissue advisory that was in place at the time of the listing. The EPA-promulgated water quality criterion for dioxin is 0.014 ppq. In 2003, the Florida Department of Health rescinded this advisory based on fish tissue data collected at key points along the river in July 2003 (see Table 8). While the data indicates an improvement in water quality, it does not indicate that water quality standards are achieved.

Table 8. Dioxin Concentrations in Fish Tissue

Sample ID	Sample Size (g)	Concentration (pg/g)	Remark Code (see note 3)
Composite # 1	24.79	0.0959	A
Composite # 2	25.1	0.0890	
Composite # 3	25.55	0.251	A
Composite # 4	24.99	0.196	A
Composite # 5	24.89	0.669	A
Composite # 6	25.06	-0.154	

Notes: 1) sample size refers to the fish weight in grams (g); 2) concentration reported in picograms per gram (pg/g) or parts per trillion (ppt); and 3) A remark code of 'A' represents a detected level below the lowest calibration point in the standardization curve. This level meets all of the data requirements for an acceptable, quantified point and is used in the calculations.

EPA reviewed the data used to rescind the advisory and determined water quality standards are not being met for dioxin. This decision was based on estimated fish tissue residue levels used to derive the water quality criterion for 2,3,7,8-TCDD of 0.014 ppq. Risk assumptions used in the calculations to derive the criterion include: a fish consumption rate of 6.5 gram/day; an average body weight of 70 kilograms (kg); a cancer risk level of 1 in 1 million; and a cancer potency slope of 1.56×10^5. This results in a fish residue concentration of 0.07 parts per trillion (ppt) of 2,3,7,8-TCDD. Of the six samples available for analysis, five had levels above the 0.07 ppt threshold. In these five samples the concentration of 2,3,7,8-TCDD ranged from 0.089 to 0.669 ppt (see Table 8). The sixth sample was determined to be nondetect due to matrix interference with an estimated maximum possible concentration of 0.154 ppt.

6.2 Source Assessment

Dioxin does not occur naturally, or if it does it is at levels that cannot be detected in the environment. Dioxin can be discharged into surface waters from pulp mill operations like Buckeye. The pollutant 2,3,7,8-TCDD is no longer a byproduct of the pulp mill, as the facility made a substitution of chlorine dioxide as a bleaching agent; however, concentrations of the pollutant may remain in the facility's treatment lagoons. Therefore, the potential exists for dioxin to be released into the Fenholloway River.

6.3 Analytical Approach and TMDL Components

The approach for calculating the dioxin TMDL is a direct application of the numeric criterion (0.014 ppq) to point and nonpoint sources of dioxin. Since the Fenholloway River is an effluent dominated system, the WLA assumes no dilution is available. Therefore the TMDL equals the WLA which equals the human health criterion for 2,3,7,8-TCDD (see Table 9). The criterion was derived based upon an annual average concentration endpoint for which protection is provided as long as the concentration remains below 0.014 ppq on an annual average basis. However, given the extent and capabilities of measuring dioxin at these concentrations, the above WLA is established as a maximum that should not be exceeded in any given day. This also meets the requirement that TMDLs should include a daily expression.

Table 9. Dioxin TMDL Components

WBID	Parameter	WLA (maximum)	LA	TMDL
3473A	2,3,7,8-TCDD	0.014 ppq	0.014 ppq	0.014 ppq

6.4 Margin of Safety

An explicit MOS is provided by using the human health criteria, assuming no dilution, and expressing the allocation as a maximum allowable daily concentration.

6.5 Seasonal Variation

Establishing the WLA and TMDL at the human health criterion for dioxin provides year round protection**.**

7 Fecal Coliform TMDL for Bevins / Boggy Creek

This section of the report details the development of a fecal coliform TMDL in Bevins (Boggy) Creek. Fecal coliforms are a subset of the total coliform group and indicate the presence of fecal material from warm-blooded animals.

7.1 Watershed Characterization

Bevins (Boggy) Creek is located in Taylor County in the Steinhatchee Planning Unit. The Steinhatchee is part of the Suwannee River Basin. Bevins Creek is a tributary to the Steinhatchee River, which discharges into the Gulf of Mexico (see Figure 3). Land cover in the watershed is shown in Table 3 and is based on the National Land Cover Dataset (NLCD) obtained from 1990 Landsat Thematic Mapper Data (Vogelmann, 2001). Wetlands and forested areas are the dominant features of the Bevins Creek watershed. Although the NLCD data is from 1990 images, land cover in the Taylor County area has not changed significantly. According to the FDEP Basin Status Report for the Suwannee Basin, the Steinhatchee River watershed is 98 percent pine flatwoods and wetlands, most of which is used for commercial timber production (FDEP, 2001).

7.2 Water Quality Assessment and Deviation from Target

FDEP maintains an ambient monitoring station on Bevins (Boggy) Creek at State Route 51 near the confluence of the Steinhatchee River. Fecal coliform and fecal streptococci data were collected at this station in 1989 and again in 2002, but only for fecal coliform. The available data used in the TMDL analysis is provided in Table 10. The ratio of fecal coliform (FC) to fecal streptococci (FS) was calculated with the available data, and the results are provided in Table 10. It is important to note that the flow was not measured at the time of sampling. A statistical summary of the data is provided in Table 11.

Table 10. Fecal Coliform Data Collected in Bevins (Boggy) Creek

Date	Fecal Coliform (MPN/100ml)	Remark Code	Fecal Streptococci (MPN/100ml)	Remark Code	FC:FS Ratio
2/8/89	170		20		8.5
4/5/89	400		43		0.56
6/7/89	2000	L	720		0.74
8/16/89	20		2700		0.47
9/4/02	64				
9/11/02	46				
9/24/02	72				
10/16/02	1800				
10/24/02	520				
11/6/02	150				

Date	Fecal Coliform (MPN/100ml)	Remark Code	Fecal Streptococci (MPN/100ml)	Remark Code	FC:FS Ratio
12/3/02	28				

Note: Remark code "L" refers the value is off-scale high; actual value is not known, but known to be greater than the value shown.

Table 11. Statistical Summary of Fecal Coliform Data in Bevins(Boggy) Creek

Parameter	Geometric Mean	No. Samples Exceeding Criteria	Minimum (MPN/100ml)	Maximum (MPN/100ml)
Fecal Coliform	N/A	3 of 11 or 27%	20	2000

Note: N/A means not available as an insufficient number of samples were collected in a 30-day period to calculate the value.

The target for the fecal coliform TMDL is the not to exceed 400 counts in 10 percent of the samples and not to exceed 2400 counts at any time, respectively. By meeting water quality standards using the percent exceedance frequency for fecal coliform the chronic criteria also should be met.

7.3 Source Assessment

An important part of the TMDL analysis is the identification of source categories, source subcategories, or individual sources of coliform bacteria in the watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either point or non-point sources. The ratio of fecal coliform to fecal streptococci can provide a general indication of the source of impairment. In general, the higher the ratio the more likely the sources of the bacteria are human. Table 10 provides the ratio of fecal coliform to fecal streptococci, and in most cases the ratio was less than 1, indicating animal influence as the probable source of contamination.

A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source discharges of industrial wastewater and treated sanitary wastewater must be authorized by National Pollutant Discharge Elimination System (NPDES) permits. NPDES permitted facilities discharging treated sanitary wastewater or stormwater (i.e., Phase I or II MS4 discharges) are considered primary point sources of coliform.

Non-point sources of coliform are diffuse sources that cannot be identified as entering a waterbody through a discrete conveyance at a single location. These sources generally, but not always, involve accumulation of bacteria on land surfaces and wash off as a result of storm events. Typical non-point sources of coliform include:

Wildlife
Agricultural animals
Onsite Sewer Treatment and Disposal Systems (septic tanks)
Urban development (outside of Phase I or II MS4 discharges)

7.3.1 Point Sources

There are no point sources located in the Bevins Creek drainage area that possess NPDES permits for discharges of treated sanitary wastewater.

Municipal Separate Storm Sewer Systems (MS4s) may also discharge bacteria to waterbodies in response to storm events. An urbanized area is defined as an entity with a residential population of at least 50,000 people and an overall population density of 1,000 people per square mile. There are no municipalities in the Bevins Creek watershed classified as an MS4 area. All future MS4s permitted in the area are automatically prescribed a WLA equivalent to the percent reduction assigned to the LA.

7.3.2 Non-point Sources

73.2.1 Wildlife

Wildlife deposit bacteria with their feces onto land surfaces where it can be transported during storm events to nearby streams. The bacteria load from wildlife is assumed background, as the contribution from this source is small relative to the load from urban and agricultural areas. In addition, any strategy employed to control this source would probably have a negligible impact on obtaining water quality standards.

7.3.2.2 Agricultural Animals

Agricultural activities including runoff from pastureland and cattle in streams have the potential to impact water quality. Based on land cover in the watershed and information provided in the Suwannee Basin Status Report, agricultural activities are not considered a significant source of coliform impairment.

7.3.2.3 Onsite Sewerage Treatment and Disposal Systems (Septic Tanks)

Onsite sewage treatment and disposal systems (OSTDs) including septic tanks are commonly used where providing central sewer is not cost effective or practical. When properly sited, designed, constructed, maintained, and operated, OSTDs are a safe means of disposing of domestic waste. The effluent from a well-functioning OSTD is comparable to secondarily treated wastewater from a sewage treatment plant. When not functioning properly, OSTDs can be a source of nutrient (nitrogen and phosphorus), pathogens, and other pollutants to both ground water and surface water.

Septic tanks are the predominant method of domestic wastewater disposal in the Suwannee Basin. In the Bevins Creek watershed, urban area accounts for less than one percent of the total area. Because the population density is low, septic tanks are not a significant area of concern.

7.3.2.4 Urban Development

Fecal coliform loading from urban areas is attributable to multiple sources including storm water runoff, illicit discharges of sanitary waste, runoff from improper disposal of waste materials, leaking septic systems, and domestic animals. The Bevins Creek watershed contains little urban development; however, rural farms with animals having access to streams can be a significant fecal coliform source.

7.4 Analytical Approach

The approach for calculating coliform TMDLs depends on the number of water quality samples and the availability of flow data. When long-term records of water quality and flow data are not available, as is the case for Bevins Creek, the TMDL is expressed as a percent reduction. The reduction is based on instream samples violating the water quality criteria and the target concentration.

The TMDL is expressed as a daily load by multiplying the water quality target by an estimate of flow in Bevins Creek. A weighted drainage area approach is used to estimate flow in Bevins Creek. In this approach, flow at an ungaged site is calculated by multiplying flow measured at a gaged site by the drainage area ratio of the two sites. A weighted drainage approach is an appropriate method to calculate flow when the two watersheds are of similar size and land use distributions. The USGS gage located on the Fenholloway River near Foley, FL (USGS 02324400) is used to estimate flow in Bevins Creek. The drainage area at the Fenholloway gage is about 60 square miles, while the drainage area of Bevins Creek is 35 square miles. Land cover in both watersheds is predominately forest and wetlands (see Table 2 and Table 3). The drainage area ratio of Bevins Creek and the Fenholloway River is 0.58 (i.e., 35/60 = 0.58). Based on flow measurements recorded at the USGS gage between January 1985 and April 2007, the median flow in the Fenholloway River at the gage near Foley, FL was estimated at 8.4 cfs. The estimated median flow and daily load in Bevins Creek is calculated as follows:

Flow (ungaged site) = Flow (gage stream) * (area of ungaged site/area of gage sited)
Flow Bevins Creek = 8 cfs * (35/60) = 4.8 cfs

Load (MPN/day) = 4.8 cfs * 400 MPN/100ml * (28317 ml/cubic ft *86400 sec/day)
Load (MPN/day) = 4.74×10^{10}

7.4.1 Development of Total Maximum Daily Loads

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-stream water quality conditions. A TMDL can be expressed as the sum of all point source loads (WLA), non-point source loads (LA), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$TMDL = \Sigma WLAs + \Sigma LAs + MOS$$

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR §130.2 (i) states that TMDLs can be expressed in terms of mass per time (e.g. pounds per day), toxicity, or other appropriate measure. The TMDL for Bevins Creek is expressed in terms of a daily load and a percent reduction. The percent reduction is based on the maximum concentration exceeding the water quality target of 400 MPN/100ml. Best management practices (BMPs) that achieve the prescribed percent reduction should be used to implement the TMDL.

7.4.2 Critical Conditions

The critical condition for non-point source coliform loading is an extended dry period followed by a rainfall runoff event. During the dry weather period, coliforms build up on the land surface, and are washed off by rainfall. The critical condition for point source loading occurs during periods of low stream flow when dilution is minimized. Critical conditions are accounted for in the TMDL by using the maximum concentration measured in the stream. By meeting water quality standards with this data violation, standards should be met for all other coliform criteria.

7.4.3 Existing Conditions

Existing conditions are based on the instream water quality violations. When only a few samples exceed the target, the most recent measurement is used to represent existing conditions.

7.4.4 Margin of Safety

There are two methods for incorporating a MOS in the analysis: a) implicitly incorporate the MOS using conservative model assumptions to develop allocations; or b) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. In the Bevin Creek TMDL an implicit MOS was used, as the target concentration is the not to exceed criterion

of 400 MPN/100ml in 10 percent of the samples and the TMDL does not allow for this 10 percent exceedance frequency. This criterion is considered more stringent than the one day maximum concentration of 800 MPN/10ml.

7.5 Determination of TMDL Components

The TMDL components are expressed as percent reductions necessary to maintain water quality standards and as a daily load. The TMDL value is reduced by the WLA, if any, to obtain the LA component. TMDL components are shown in Table 12.

There are no NPDES permitted facilities discharging fecal coliform to Bevins Creek; therefore, the WLA is equal to zero. Any future facility permitted to discharge fecal coliform bacteria in the watershed will be required to meet permit limits. Future facilities discharging at concentrations less than the water quality standard should not cause or contribute fecal coliform bacteria impairment in the watershed.

The reduction prescribed for the LA is based on the following equation:

Reduction = ((maximum concentration – target)/max. concentration) * 100

For fecal coliform the LA component is calculated using the concentration of 1800 counts/100ml measured on October 16, 2002. The percent reduction from current conditions is:

Reduction = ((1800 – 400) / 1800) *100 = 78 %

Table 12. TMDL Components for Bevins (Boggy) Creek

Parameter	WLA	LA	MOS	TMDL
Fecal Coliform	0	78 %	Implicit	78 %

Note: In terms of daily load, the TMDL is equivalent to 4.74×10^{10} MPN/day. In the absence of NPDES discharges, the LA is equal to the TMDL.

7.6 Seasonal Variation

Seasonal variation was incorporated in the TMDL analysis by using all water quality data associated with the impaired streams, which was collected during multiple seasons.

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